Report of August 2014 Meeting
Royal Society
Southern Highlands Branch

Speaker: **Scientia Professor Veena Sahajwalla**
Director, Centre for Sustainable Materials Research and Technology, University of New South Wales, Sydney.
***OneSteel, Sydney, Australia**

Topic: **Green Materials and Recycling End-of-Life Polymers in Steelmaking. An example of successful translation of research into industry.**

Professor Sahajwalla's research has completely changed our understanding of the properties of carbon-bearing materials such as coals, cokes, graphites, plastics and rubber tyres. Worldwide, the carbon-based industries of ironmaking, steelmaking and ceramics are huge, and she has had a significant impact on the theory and practice that form the basis of the operations.

In particular, she has demonstrated how waste plastics and waste rubber can be valuable components as a partial replacement of coal and coke in EAF steelmaking. In bridging the gap between pure and applied research, she has focused on the behavior of carbon in high-temperature conditions, and has provided fundamental understanding of materials processing in these industries. This work is providing the opportunity for industry to work towards environmentally friendly and cost-efficient production methods. Already more than 1.5 million tyres have been prevented from ending up in landfill.

Importantly, the commercialization arm of UNSW has signed an agreement with Australia's largest manufacturer of steel long products, OneSteel, to allow the sublicensing of this unique technology.

Professor Sahajwalla spent a large portion of her lecture discussing her team's research into a solution for ASR – automotive shredder waste. This is the most problematic of the non-metal components of vehicles that cannot be recycled easily, and which include items such as plastics, windscreens and other glass. The problems associated with the recycling of windscreens arise because of the lamination used to create safety glass.

According to the US Environmental Agency, about 80% of a waste vehicle by weight can currently be recycled. Last year of the more than 85 million new cars and light commercial vehicles that came on the world's roads, the single largest number, almost 20 million, were purchased in China. Overall there were 27 million more vehicles worldwide than a decade ago. In addition, vehicles everywhere are now being replaced in ever shorter cycles. The ASR, which is being produced in increasing quantities all over the

world, is essentially a mixture of ground plastics, rubber, textiles, fibrous materials and wood, contaminated with metal slivers and oil. For every vehicle, some 120 kg of ASR ends up in landfill.

Professor Sarajwalla emphasized that traditional recycling focuses on using materials in their original form, glass into glass, steel into steel, but that this model does not work for more complex materials. There is no easy way to recycle complex materials simply into their original form. Her team has now taken a completely new approach of looking at materials in terms of their elements. In other words, through innovation, they are considering complex waste as a valuable resource of elements.

Professor Sarajwalla is hoping that a solution for the ASR problem could lead to vehicles being 100% recyclable. Her research is building on the success she has achieved in using high temperature reactions to convert waste tyres and plastic into valuable materials for steel production. In the case of ASR, she is already achieving promising results using it in the production of metal alloys.

She commented that over the last 50 years, humans have consumed more resources than in all previous history. The US EPA reported in 2009 that while the world's population is projected to grow 50% between 2000 and 2050, global energy and material use will probably grow by 300 %. She told the 50 person audience that she is confident that there will be solutions, but added that those solutions will be heavily reliant on innovation and investment.

Anne Wood